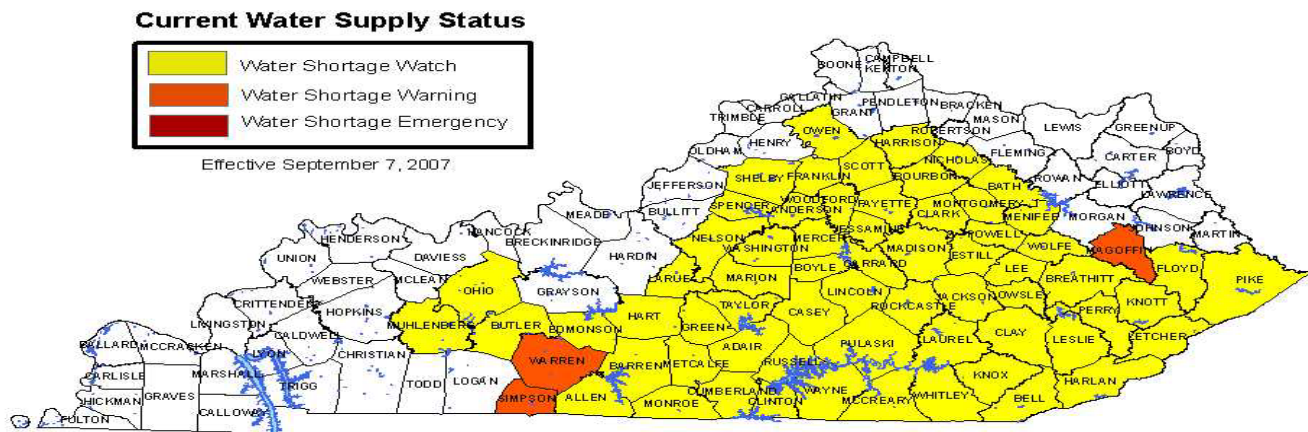


Drought

The Kentucky Division of Water continuously monitors hydrologic conditions throughout the state, including precipitation, streamflows, lake elevations and various drought indices. This information is used to detect emerging drought conditions, to identify the locations and severity of drought and to provide timely and appropriate public notification.

Kentucky Drought Monitoring Center



***UPDATE* Sept. 7, 2007 - State
Issues Water Shortage
Warnings for Magoffin and
Simpson Counties and Extends
Water Shortage Watch (To
view press release please [click
here.](#))**

[Water Shortage Notification System Explained](#)

[Water Shortage Response Status](#) of known public water
systems reported to the Division of Water.

**Statewide Summary of Drought
Development**

 **Updated Sept. 13, 2007** 

The most recent drought indices (Palmer Drought Severity Index and Drought Monitor) indicate a deepening of drought conditions across most of Kentucky. However, these indices did not fully account for the precipitation that moved across Kentucky on Sept. 11-12. Some of these storms brought 1 to 2 inches of beneficial rainfall to areas that needed it most, including the headwaters of the Kentucky and Licking rivers, the Barren River basin and the upper Green River basin.

The outlook for at least the next 14 days does not indicate more than slight chances for significant rainfall. As was demonstrated by the rapid development of Hurricane

Humberto this week, the possibility of tropical moisture tracking into Kentucky is always something that can change conditions in Kentucky substantially during the hurricane season (remember Hurricane Katrina in the last days of August in 2005). However, hopes for drenching storm systems from remnants of tropical storms should not be a part of our strategy to manage water supplies diminished by drought.

There are currently at least 27 water systems in Kentucky that have in place some level of water shortage response. Many of these are proactive in nature and are intended to reduce demand for water before a water shortage situation develops. Others are in direct response to immediate concerns with low streamflows or declining levels of water supply reservoirs. It is important for all Kentuckians to comply as fully as possible with any requests made by their water suppliers to help conserve water.

Useful Drought Indicators

PRECIPITATION

For the seven day period ending Sept. 12, 2007, the entire state saw some precipitation. Precipitation for the past 30 days in the Eastern, Bluegrass and Western climatic divisions averaged 61 percent of normal (66, 55 and 63 percent of normal respectively) while the Central climatic division's average has risen to 94 percent of normal.

STREAMFLOWS

Streamflows across the state have responded favorably to recent rainfall. A number of streams that had declined to near critical levels are temporarily flowing within a normal range for this time of year. However, there are isolated areas that missed out on the latest round of rain where streamflows remain below-normal. With short-term outlooks calling for below-normal precipitation, expect streamflows to once again decline.

LAKE ELEVATIONS

While most small water-supply lakes are not abnormally low, they continue to decline under the stress of high temperatures and lack of precipitation. Increased customer demand has forced a number of these water systems to call for conservation measures. Lakes under the control of the [Huntington District](#), [Louisville District](#) and [Nashville District](#) of the U.S. Army Corps of Engineers continue to operate along their normal lake elevation curves. Two exceptions are the Barren River Reservoir in Barren County and Rough River reservoir in Breckinridge County. Barren River reservoir is having difficulty bringing the elevation to normal pool and is currently down by 4.1 feet. Discharges from the dam have been at or near the minimum release most of the time since Mar. 20, 2007. Releases from Corps of Engineers reservoirs are important to the status of many Kentucky rivers as sources of supply for drinking water, assimilation of wastewater discharges, water quality and aquatic habitat. These rivers include the Green, Barren, Rough, Nolin, Kentucky, Salt, Licking and Big Sandy rivers.

DROUGHT INDICES

Assessing the severity of a drought is made easier with the use of drought indices that combine various source information into a single representative value of drought severity. The [Palmer Drought Severity Index](#) uses data for precipitation, temperature and evapotranspiration (the water returned to the atmosphere through the combined actions of evaporation and plant growth) to calculate a number that can be compared across different times and locations. This index was developed in the 1960's in Kansas and Nebraska but has since become a part of drought monitoring in a majority of the United States. The Palmer Drought Severity Index is updated weekly on Monday afternoons.

The [Drought Monitor](#) represents a comprehensive assessment of several factors that contribute to the development of drought or that indicate the severity and potential persistence of drought. The Drought Monitor is updated weekly on Thursday mornings.

 **Updated Sept. 13, 2007** 

The Palmer Drought Severity Index and the Drought Monitor indicate severe to extreme drought across Kentucky with the Drought Monitor moving the southeastern corner of the state to exceptional.

The Palmer Drought Severity Index issued on Sept. 10, 2007, places the Eastern, Western and Bluegrass climatic divisions in extreme drought status (-4.68, -4.39 and -3.97 respectively). The Central climatic division (-3.66) remains in Severe Palmer Drought.

It is important to note that the Palmer Drought Severity Index is used as a general index of drought over large geographic areas defined by the four climatic divisions of Kentucky. Rainfall that affects one part of a climatic division may substantially improve drought conditions on a county or multi-county level but have little or no impact on the regional average conditions defined by the Palmer Index.

 **Updated Sept. 13, 2007** 

While the Drought Monitor continues to place a majority of the state in extreme agricultural and hydrologic drought status, the area in the southeast designated as exceptional drought has expanded to 17 counties. The upper boundary of this area is formed by Clinton, Wayne, Pulaski, Rockcastle, Jackson, Owsley, Breathitt, Knott and Letcher counties. A few areas classified as severe remain. They are delineated as east of a line running south from Greenup County to Pike County and a boxed area in the central portion of the state that runs from Hancock County south to Muhlenberg County east to Lincoln County north to Anderson County and west to Jefferson County.

As a drought indicator, the Drought Monitor is not limited to four large climatic divisions, rather it incorporates the Palmer Index as just one of several indicators of drought development in a given area. These other indicators include more short-term components including the Crop Moisture Index, Standardized Precipitation Index and weekly streamflow percentiles. The Palmer Drought Severity Index and the Drought Monitor should be considered in combination with more localized data such as rainfall, streamflows, groundwater levels and climatic outlooks to form an accurate assessment of drought severity in a given location.

Drought Monitoring

Drought is a natural and recurring feature of our climate that can be considered a "severe" weather event much like a tornado, a flood or a hurricane. However, there are a few key differences that distinguish drought from other weather events that make it difficult to detect, track and respond to drought.

Part of the difficulty in detecting drought is in the lack of an obvious onset of drought conditions. A drought develops slowly and can appear to mimic a normal spell of dry weather in the summer, a time of the year when dry weather is accepted and expected. Short-term rainfall shortages create problems for agricultural crops, livestock, urban landscapes and other activities that depend on stored soil moisture between rainfall events. We are accustomed to dealing with short-term dry spells in part because there is an expectation that rainfall is just around the corner. However, when rainfall shortages persist for weeks or months at a time, activities that depend on long-term storage of water will be adversely impacted as well. Droughts in Kentucky can have serious negative consequences for drinking water supplies, energy production, commercial and industrial operations, recreation and aquatic habitat.

The negative impacts of drought cannot be avoided but there are ways to reduce them to a manageable level. All water suppliers in the commonwealth should have a water shortage response plan to guide both the supplier and customer during a drought event. It is important for customers to listen to their water suppliers and be ready to take necessary actions to prevent a water shortage problem from developing. This is critical to a successful outcome because the only way to effectively manage the source of water supply is to first manage the demand for water.

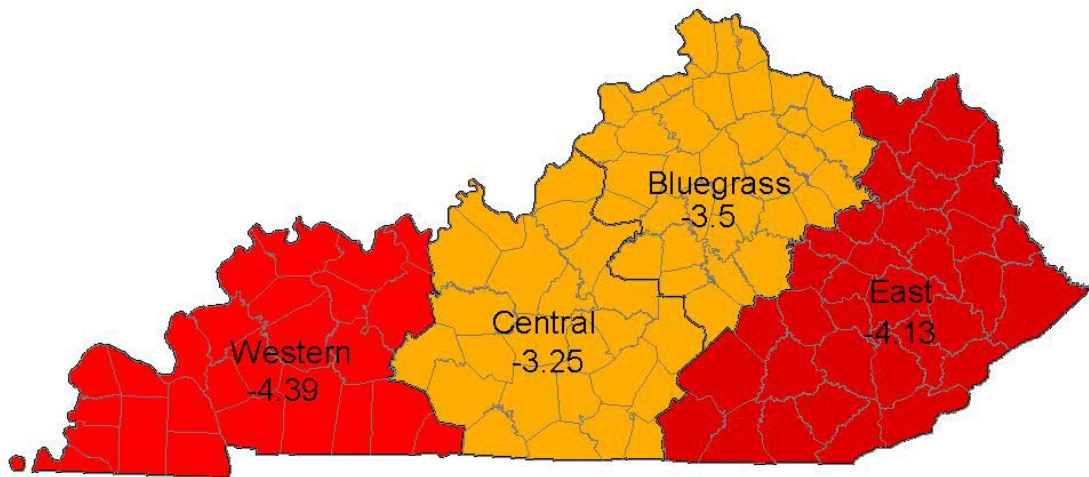
There is no easy method for determining when a dry spell has become a drought, how long a drought will persist or how intense a drought may become. However, by closely tracking certain sources of information, referred to as drought indicators, it is possible to detect potential drought development early enough to allow at least some lead-time for notification and initiation of drought response preparations at the local level. The Division of Water monitors for the potential development of drought in Kentucky by tracking precipitation, streamflows, lake levels, groundwater and water supplies. There are also several tools that are useful in assessing the severity of a "dry spell" and the potential impacts to agriculture, forest fires, water supplies and other vulnerabilities to drought. These tools include the Palmer Drought Severity Index, the Drought Monitor, the Standardized Precipitation Index and several others.

The Drought Monitoring pages will be updated on a weekly basis to provide timely information and assessments of current drought conditions in Kentucky. There will also be numerous links to other resources and drought information pages from various state and federal agencies.

 **Updated Sept. 13, 2007** 

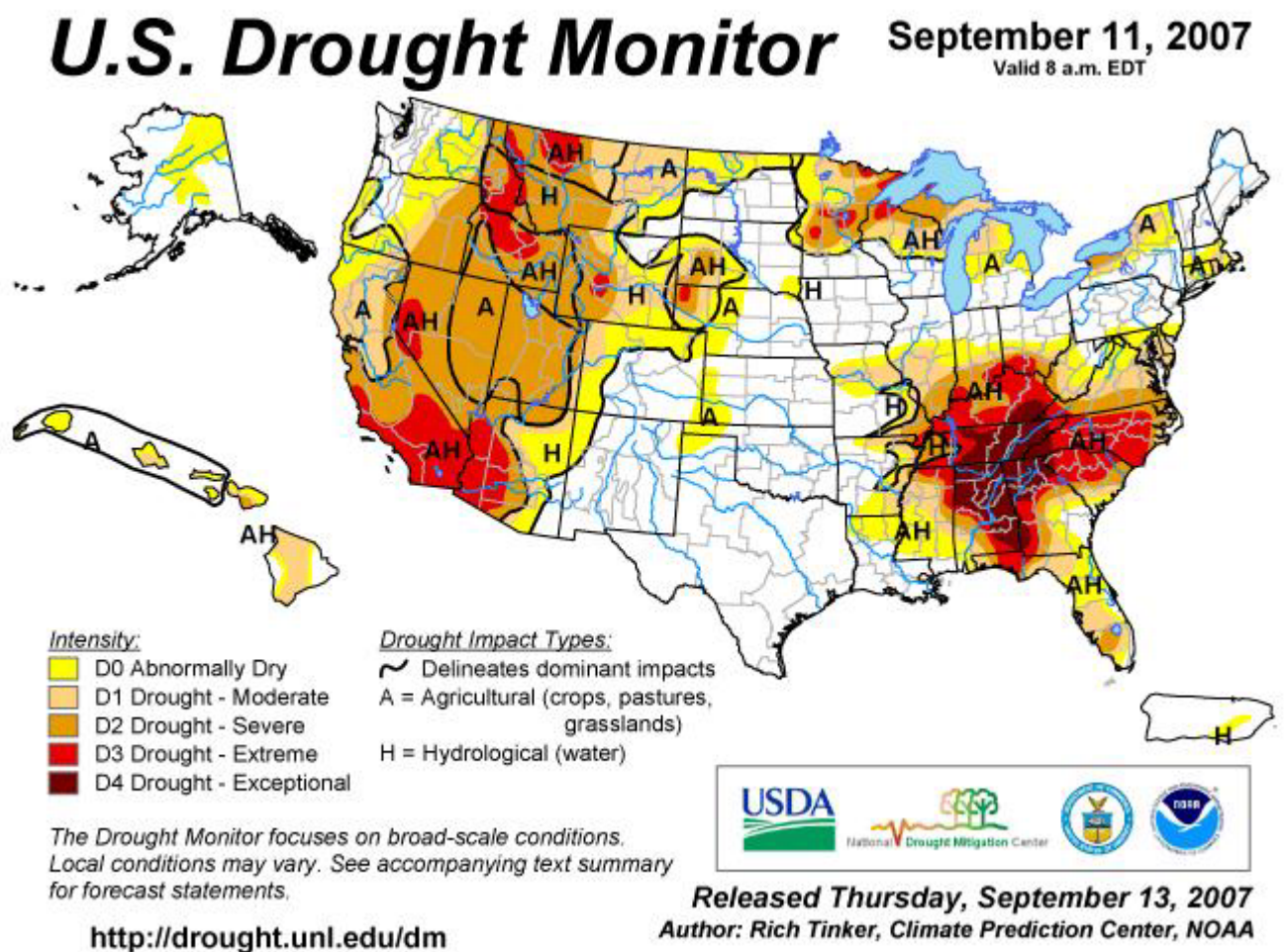
Palmer Drought Severity Index The Palmer Drought Severity Index (PDSI) is compiled weekly by the Central Region Climate Prediction Center (National Centers for Environmental Prediction, National Weather Service and National Oceanic and Atmosphere Administration) and provided on the University of Kentucky Agricultural Weather Center's Web site. This index is useful for placing a developing drought into context with past droughts and serves as a measure of current conditions. The index also provides a standardized assessment of developing drought conditions that can be compared between different areas of the state or even between different states.

PDSI values can be categorized as follows:



- 0 to -0.99 = near normal
- -1.00 to -1.99 = mild drought
- -2.00 to -2.99 = moderate drought
- -3.00 to -3.99 = severe drought
- -4.00 and below = extreme drought

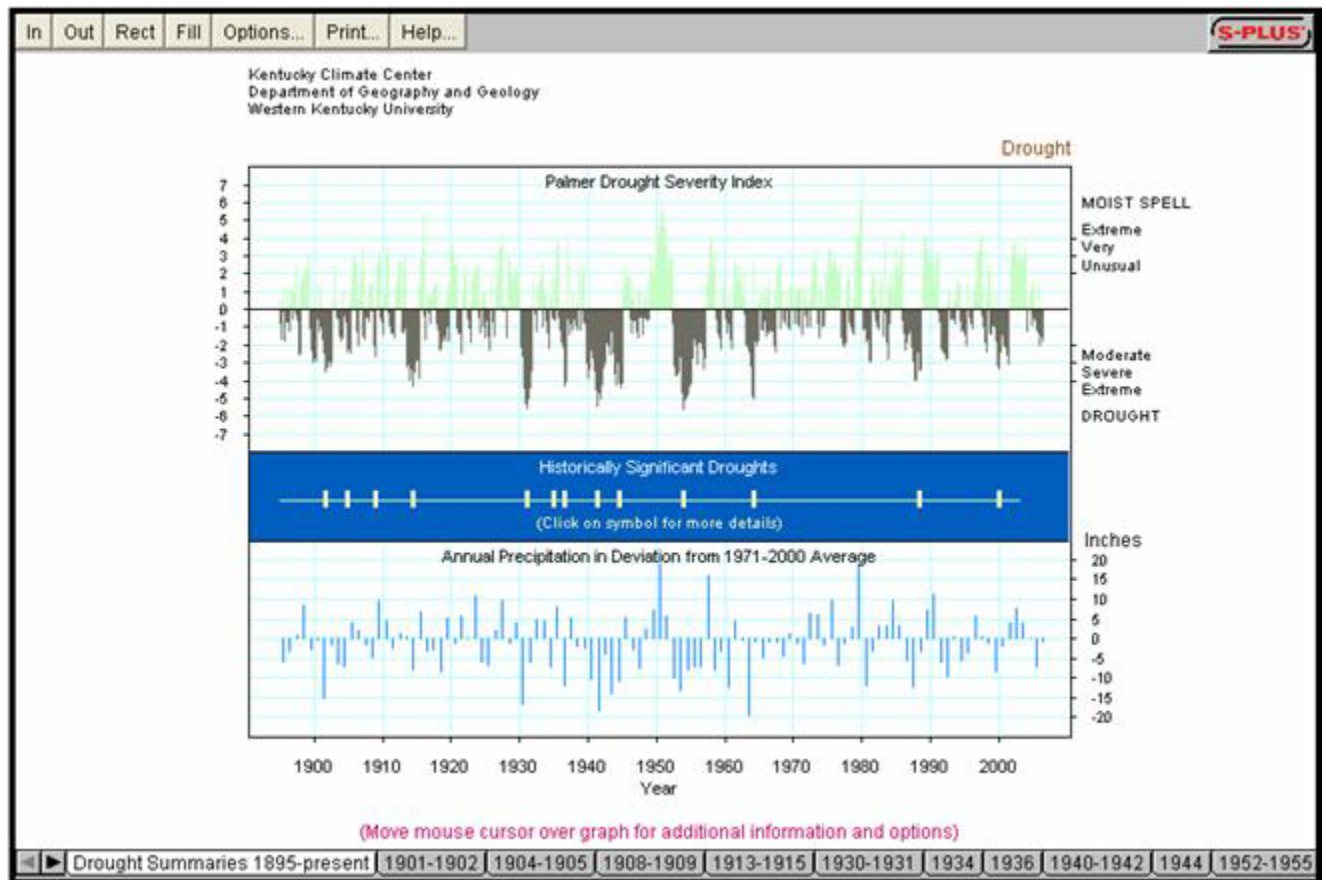
The Drought Monitor



Tracking drought blends science and art. No single definition of drought works for all circumstances, so people rely on drought indices to detect and measure droughts. But no single index works under all circumstances, either. The Drought Monitor is a synthesis of multiple indices, outlooks and news accounts, that represents a

consensus of federal and academic scientists. A detailed description of the parameters used to create the Drought Monitor can be found [here](#).

[Kentucky Climate Center](#) Historical Drought Data

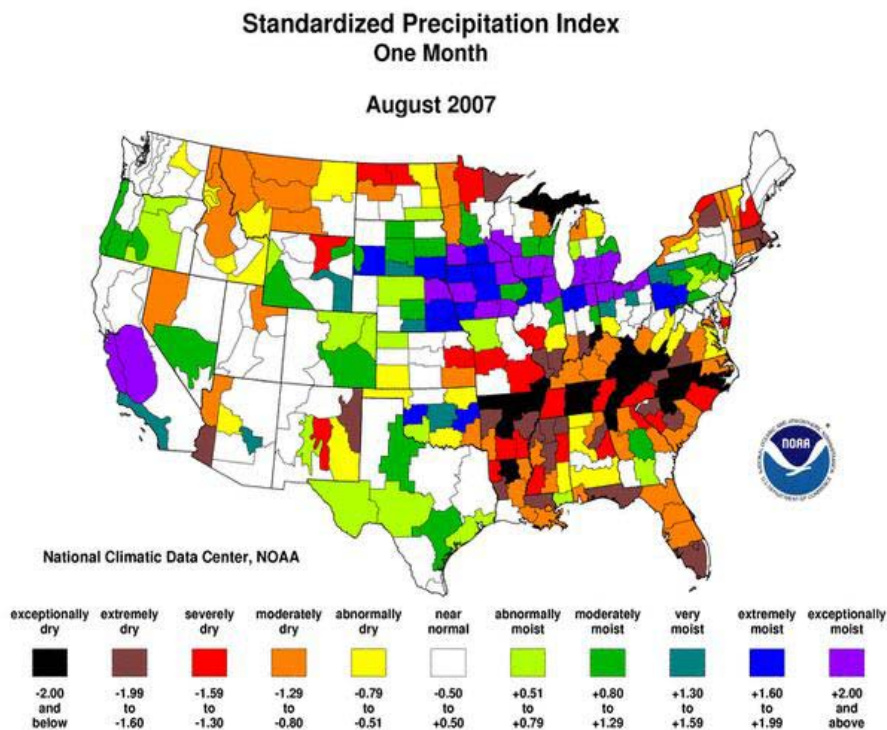


Interactive graphs displaying drought indices since 1895 for Kentucky's four climate divisions. Users can identify and explore the development of historically significant droughts.

Examining the past can be a useful tool in interpreting the significance of a developing drought situation. Comparisons of the current drought to the historical record provide a frame of reference for evaluating how serious the current drought has become, and how it might develop in the coming months. One of the best tools to evaluate past droughts is found at the Kentucky Climate Center at Western Kentucky University. Click on the figure at the left to visit this site and learn more about the history of drought in Kentucky.

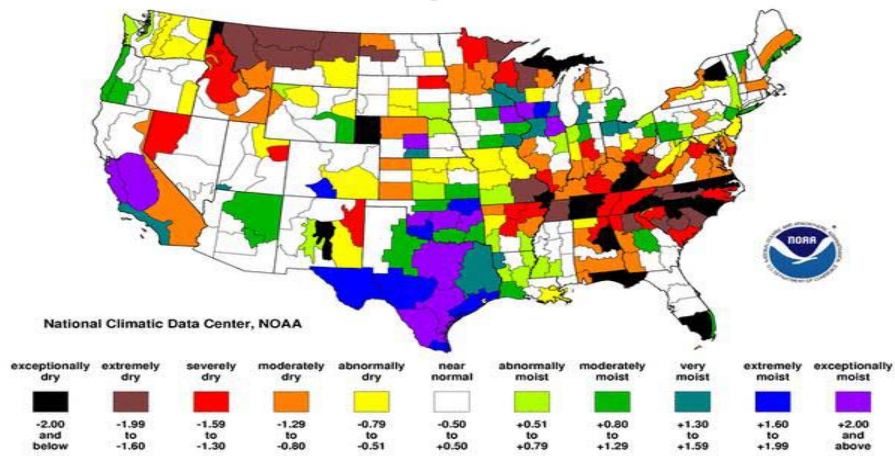
The Standardized Precipitation Index

The Standardized Precipitation Index (SPI) is a way of measuring drought that is different from the PDSI. Like the PDSI, this index is negative for drought and positive for wet conditions. But the SPI is a probability index that considers only precipitation, while Palmer's indices are water balance indices that consider water supply (precipitation), demand (evapotranspiration) and loss (runoff).



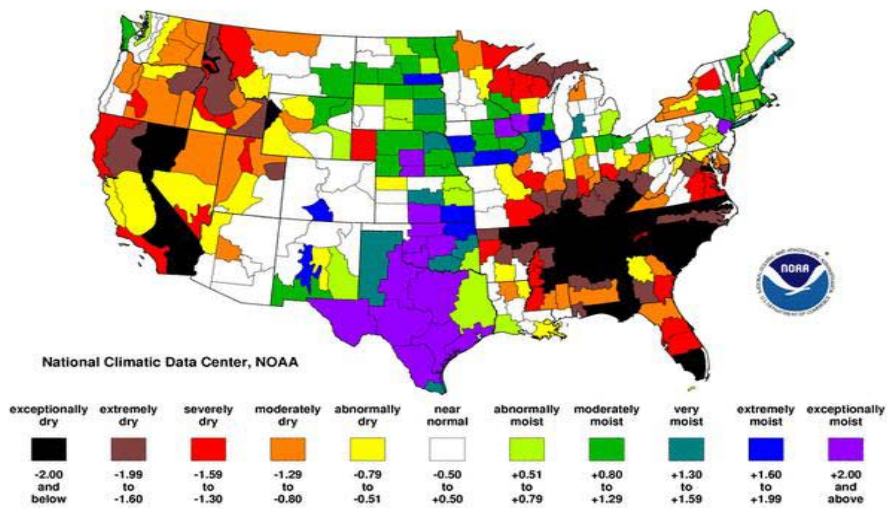
Standardized Precipitation Index Three Months

June-August 2007

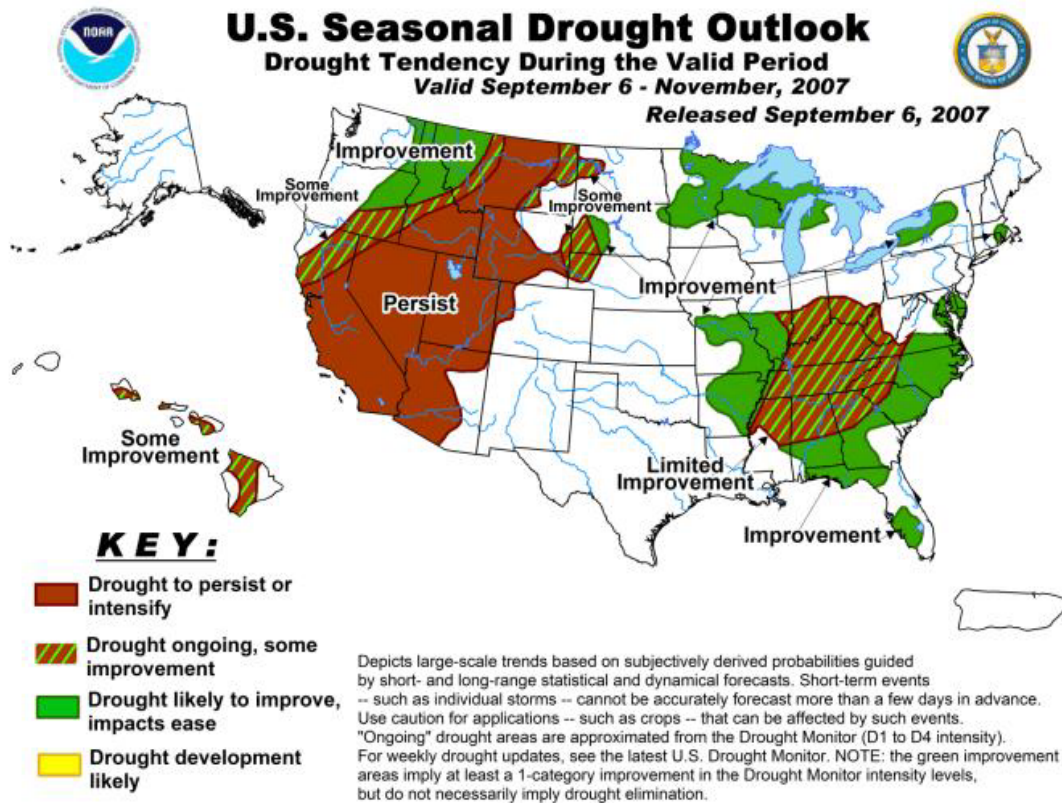


Standardized Precipitation Index Six Months

March-August 2007



U.S. Seasonal Drought Outlook



The Climate Prediction Center issues the U.S. Seasonal Drought Outlook each month in conjunction with the release of the long-lead temperature and precipitation outlooks.

Weather and Climate

PRECIPITATION

The Division of Water monitors a network of 24 daily climate-reporting stations to track developing shortages of precipitation. For the year, precipitation deficits for Kentucky range from 64 percent of normal in the Eastern climatic division to 79 percent of normal in the Bluegrass climatic division.

 **Updated Sept. 13, 2007** 

(Click on images to enlarge)

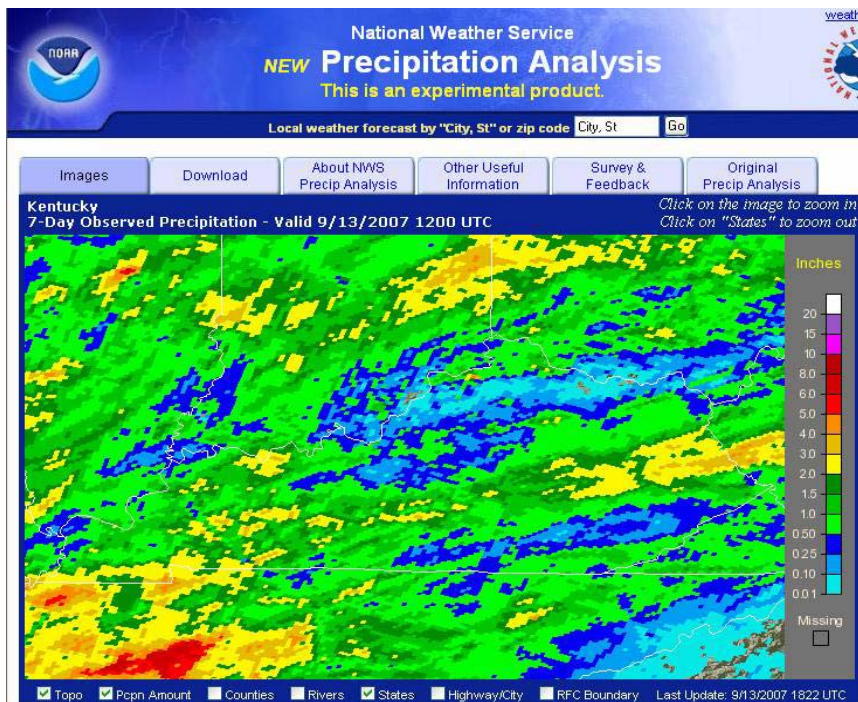
Precipitation: Data for the previous 30/60/90-day period and the Water Year Beginning October 01, 2006

Station	Water Year		30/60/90 Day Total Precipitation and Departure From Normal					
	Precipitation Totals (inches)	Departure From Normal (inches)	30 Day Total (inches)	30 Day Departure (inches)	60 Day Total (inches)	60 Day Departure (inches)	90 Day Total (inches)	90 Day Departure (inches)
Henderson	32.27	1.35	1.29	-3.28	5.88	-2.85	9.26	-4.06
Paducah	33.68	-1.04	2.32	-2.63	5.75	-4.04	8.72	-5.87
Princeton	30.11	-6.18	2.05	-2.88	5.96	-3.64	8.32	-6.07
Mayfield	27.58	-10.52	0.60	-4.16	3.85	-5.93	5.75	-9.21
Louisville	30.34	0.04	1.19	-3.26	6.33	-2.39	9.31	-3.87
Bardstown	27.05	-2.41	0.61	-3.84	5.24	-3.16	8.62	-3.98
Hardinsburg	29.47	-4.05	1.24	-3.48	5.51	-3.58	7.82	-5.70
Campbellsville	29.07	-6.24	1.69	-3.51	7.53	-2.45	11.86	-2.88
Nolin Lake	30.33	-5.12	3.35	-1.90	8.12	-1.79	10.49	-3.60
Glasgow	27.72	-8.33	1.38	-3.63	6.30	-3.32	9.49	-4.98
Bowling Green	25.25	-10.23	2.58	-2.26	6.60	-2.63	7.55	-6.52
Covington	24.60	-3.06	0.92	-3.31	3.46	-4.58	6.07	-6.02
Williamstown	32.10	2.93	1.80	-2.53	5.99	-2.51	12.43	-0.56
Spindletop	21.72	-7.66	1.30	-3.07	4.69	-3.63	7.17	-5.35
Lexington	26.89	-2.48	2.22	-2.14	5.96	-2.35	8.75	-3.76
Dix Dam	24.47	-6.36	1.26	-3.38	5.62	-3.30	9.45	-3.70
Berea	24.11	-6.60	1.49	-3.28	5.69	-3.41	9.30	-3.93
Grayson	24.78	-2.65	1.82	-2.06	5.34	-2.71	8.35	-3.19
Jackson	21.76	-9.63	1.88	-2.52	4.27	-4.27	5.67	-7.06
Quicksand	20.38	-11.12	1.87	-2.65	4.21	-4.45	5.60	-7.24
Buckhorn Lake	18.13	-12.27	0.63	-3.51	3.84	-4.09	6.00	-6.04
London	21.97	-9.18	0.96	-3.29	5.88	-2.32	6.66	-5.77
Somerset	26.75	-7.78	1.30	-3.80	5.31	-4.23	7.63	-6.30
Cumberland Gap	20.80	-14.40	0.30	-4.44	4.62	-4.30	7.75	-5.93

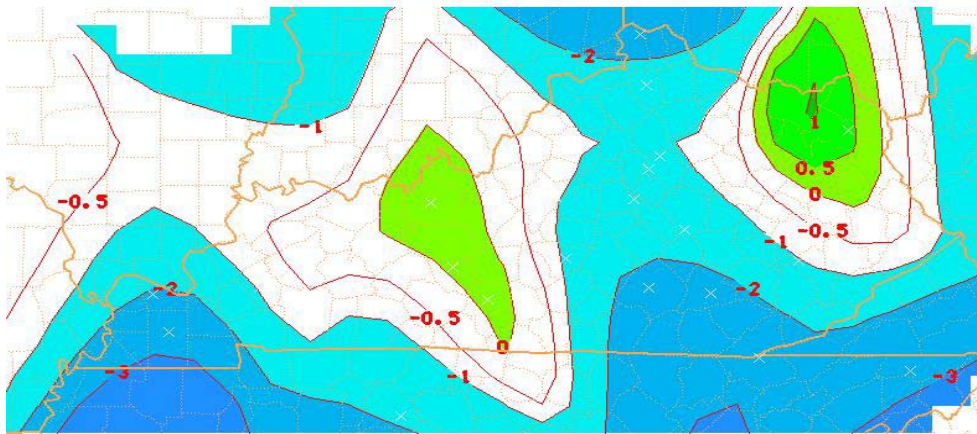
Climatic Division	Normal Precip. Water Year	Normal Precip. Calendar Year	Percent of Normal Precipitation				
			Water Year	Calendar Year	30 Day	60 Day	90 Day
Western (1)	47.44	35.19	82	69	63	52	65
Central (2)	47.28	35.63	84	79	94	80	86
Bluegrass (3)	42.45	32.34	82	76	55	72	74
Eastern (4)	45.14	34.13	69	64	66	70	69

For the seven day period ending Sept. 12, 2007, the entire state saw some precipitation. South of I-64 received the most rainfall in that timeframe with precipitation totals ranging from 0.5 to 3 inches for the majority and isolated areas of 4 inches or more. North of I-64, less than a half inch was observed for most although some areas did see up to 2 inches.

Precipitation for the past 30 days in the Eastern, Bluegrass and Western climatic divisions averaged 61 percent of normal (66, 55 and 63 percent of normal respectively) while the Central climatic division's average has risen to 94 percent of normal. Total precipitation for the period range from 0.5 to 3 inches for most of Kentucky with the Central climatic division and northern portion of the Eastern climatic division receiving from 3 to 5 inches.



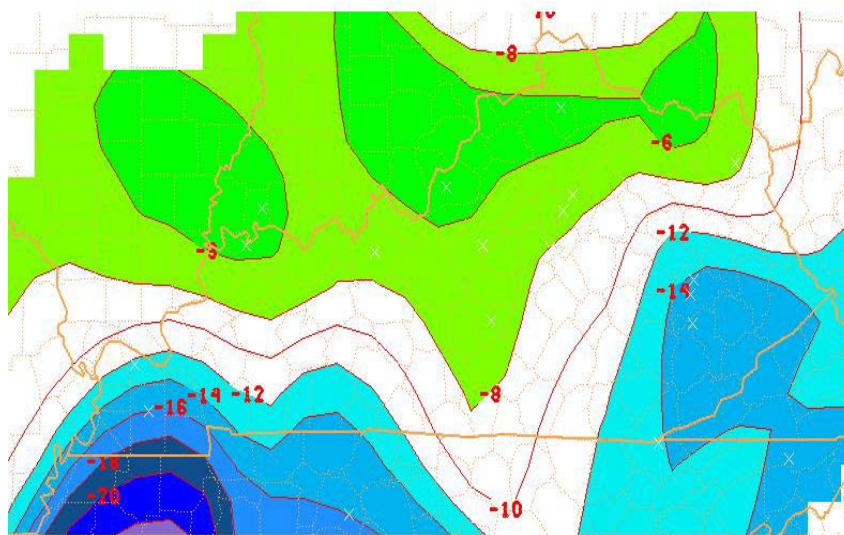
ATTENTION: One of the best tools to assess the amount and distribution of precipitation in Kentucky is the National Weather Service's [Precipitation Analysis Product](#). Data can be displayed for many different time frames and can be selected to show not only the amounts, but also the deficits and percentages of normal for each time frame.



09/13/07 - 30 Day Precip Deviation from Normal (Inches)
Ending 7 pm Yesterday



UK
University of Kentucky
College of Agriculture

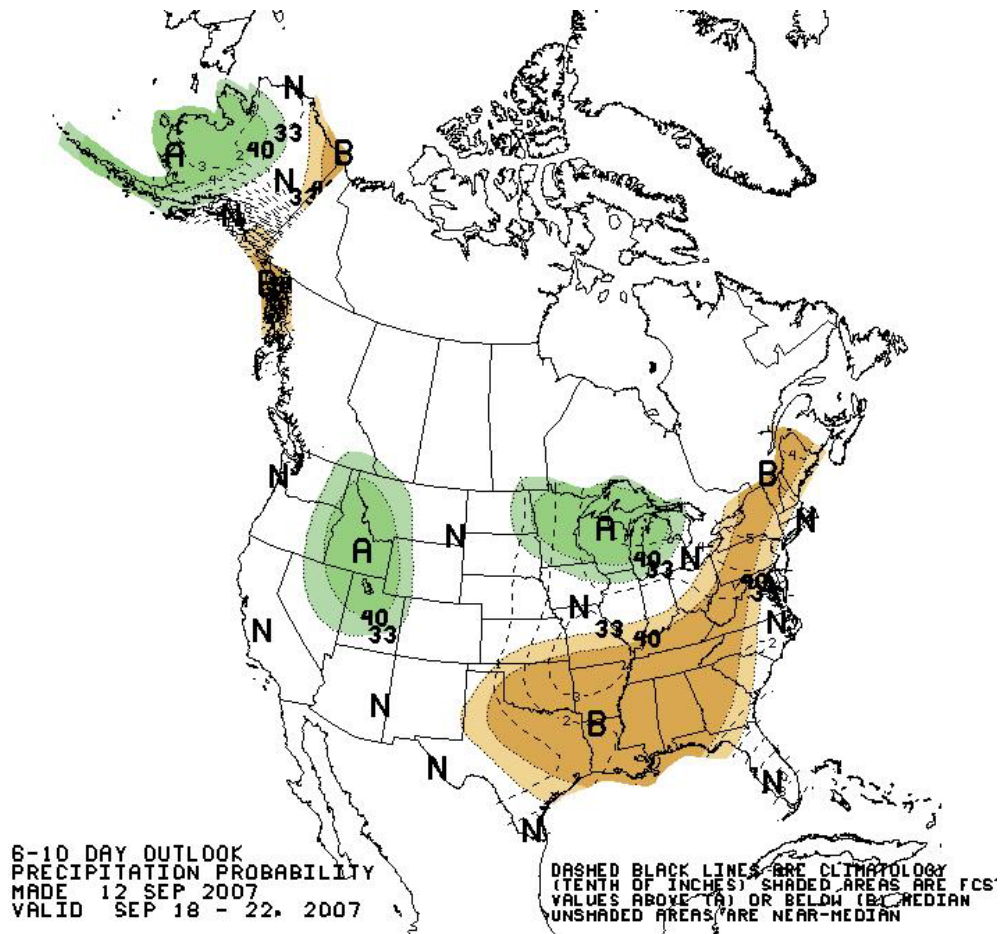


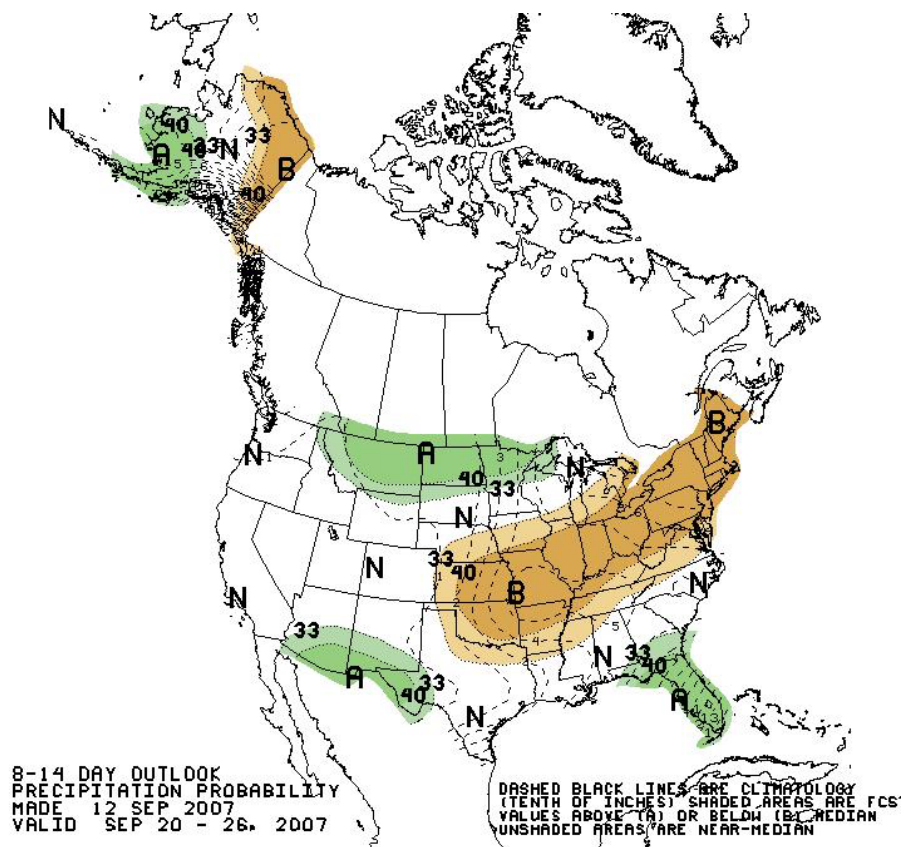
09/13/07 - Precip Deviation from Normal Since Jan 1 (Inches)
Ending 7 pm Yesterday



UK
University of Kentucky
College of Agriculture

For the year, the largest deficits remain in the southern portions of the Western and Eastern climatic divisions. Ten to 20-inch precipitation deficits have built in parts of the Purchase area of the west. The headwaters of the Kentucky, Licking, Cumberland and Big Sandy river basins in the east have areas with deficits from 12 to 16 inches for the year. Deficits range from 4 to 12 inches in the Bluegrass and parts of south-central Kentucky.





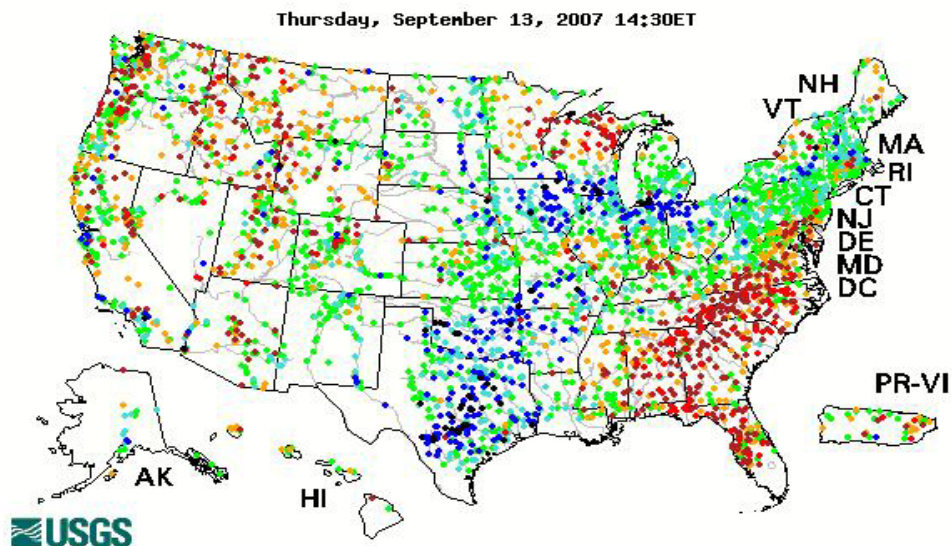
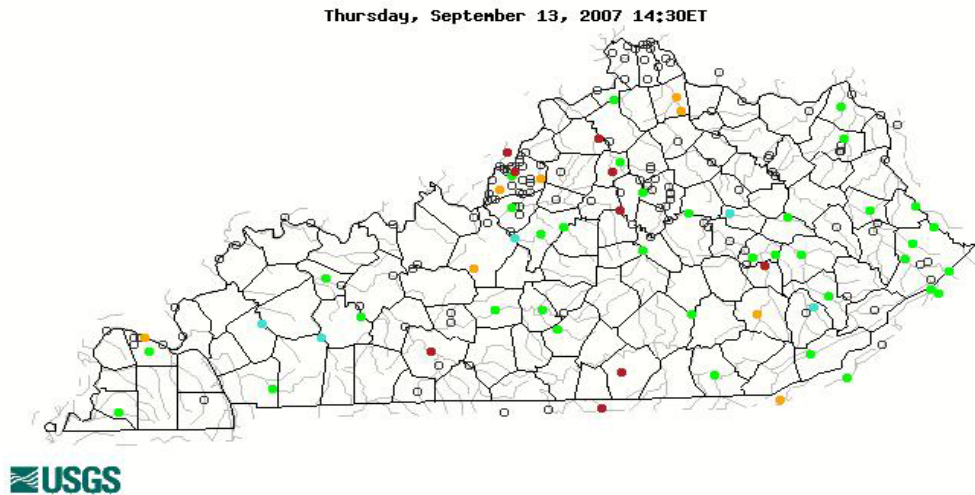
Short-term outlooks from the Climate Prediction Center indicate below-normal chances for precipitation during the next two weeks. One to three month outlooks from the Climate Prediction Center indicate equal chances for below-normal, normal and above-normal rainfall for the state.

Hydrology

STREAMFLOWS

The [U.S. Geological Survey](#) maintains a [real-time stream gauging network](#) that monitors flows in all major river basins in Kentucky. Measurements of streamflow are a very good indicator of the longer-term hydrologic impacts of drought. During the developing stages of drought, streamflows provide valuable information on the severity and regional extent of emerging problems. Streamflow data is evaluated relative to the long-term record to determine drought intensity and identify potential problems associated with water shortages. Once a drought has matured, streamflow

measurements are critical at many locations where water withdrawals have the potential to cause adverse environmental impacts to streams.



Updated Sept. 13, 2007

Streamflows across the state have responded favorably to recent rainfall. A number of streams that had declined to near critical levels are temporarily flowing within a normal range for this time of year. However, there are isolated areas that missed out on the latest round of rain where streamflows remain below-normal. With short-

term outlooks calling for below normal precipitation, expect streamflows to once again decline.

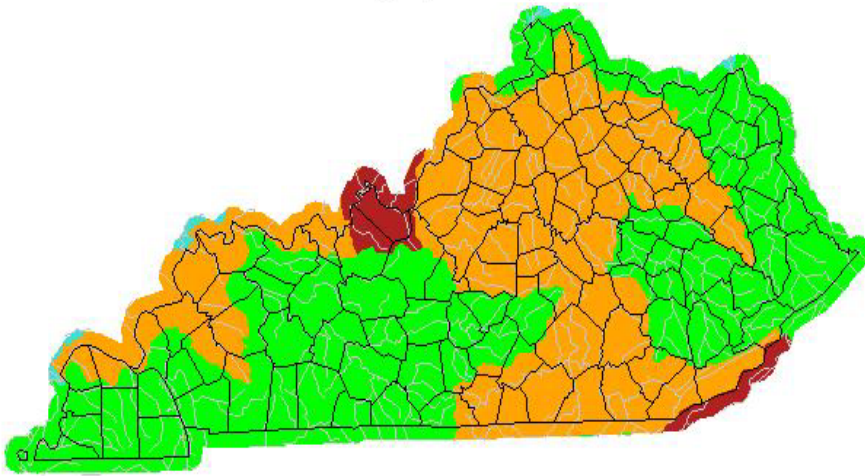
Weekly and Monthly Streamflow

For a slightly longer-term perspective of streamflow conditions across Kentucky, the United States Geological Survey computes average flows for the previous seven, 14 and 28 days. The resulting average streamflow values are categorized relative to the long-term record and assigned levels of severity based on the frequency that similar magnitudes of low-flow have occurred in the past. By averaging over a period of several days to several weeks, the values on the map are more indicative of longer-term conditions than daily average or real-time streamflow measurements.

 **Updated Sept. 13, 2007** 

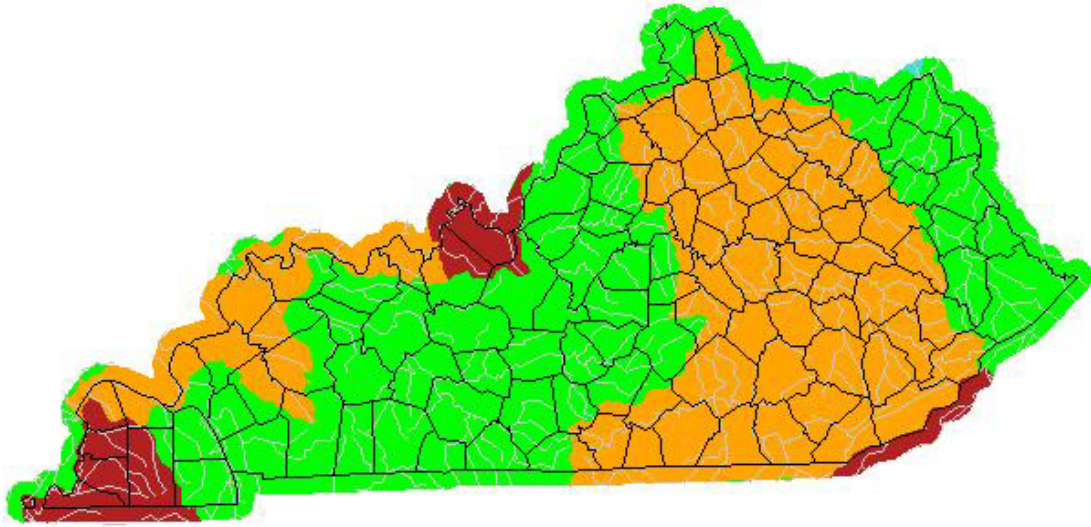
Seven-Day Average Streamflow

Wednesday, September 12, 2007



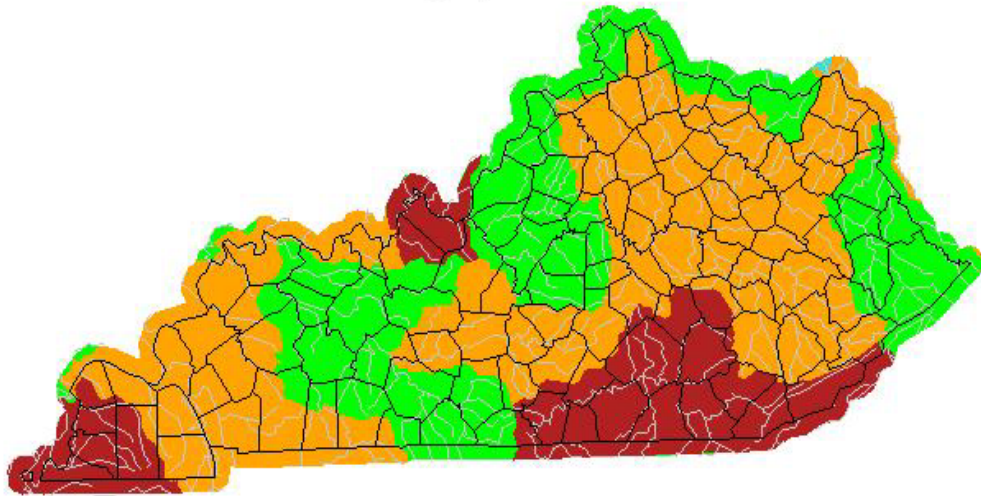
14-Day Average Streamflow

Wednesday, September 12, 2007



28-Day Average Streamflow

Wednesday, September 12, 2007



The 28-day average streamflow indicates that flows remain significantly below-normal in the Upper Cumberland River basin and the western portions of the Salt River basin and Purchase region. Elsewhere, long-term flows are below-normal in the Licking, Tradewater, Kentucky, eastern Green, Lower Cumberland and Little Sandy river basins and the eastern Purchase region. Flows in the eastern Salt, Big Sandy, western and southern Green river basin and along the Ohio River in the north are within a normal range.

Lakes and Reservoirs U.S. Army Corps of Engineers Projects

Another useful measure of the impact that drought is having on a region is the status of area lakes and reservoirs. The Division of Water monitors data from 12 projects operated by the U.S. Army Corps of Engineers (USACE) from three USACE districts: [Louisville](#), [Huntington](#) and [Nashville](#). These projects strive to maintain reservoirs at pool levels consistent with the operating guidelines as part of the larger mission of flood control and navigation in the Ohio and Mississippi rivers. Beginning in April, the releases from the reservoirs are managed to allow filling to the "normal summer pool elevation." Significant precipitation deficits in the basin above the reservoir can adversely affect the attainment of normal summer pool elevation. This, in turn, may result in low flows in the river below the project when releases from the reservoir are reduced to the minimum needed for water quality and aquatic habitat.

By examining the data for "current pool elevation" and "current outflow," valuable information about the status of large headwater areas above the USACE reservoirs can be obtained.

 **Updated Sept. 13, 2007** 

United States Army Corps of Engineer Reservoir Information Updated Sept. 13, 2007

September 13, 2006				
Basin	Project	Current Outflow (cfs)	Normal Summer Pool Elevation (ft)	Current Pool Elevation (ft)
Little Sandy	Grayson	25.2	645	642.6
	Dewey	42.0	650	650.1
	Fishtrap	83.0	757	754.6
	Yatesville	24.9	630	629.2
Big Sandy	Paintsville	12.1	709	708.7
Licking	Cave Run	50.0	730	729.2
Kentucky	Carr Creek	5.0	1027	1026.6
	Buckhorn	40.0	782	780.6
Salt	Taylorsville	32.0	547	544.2
Green	Green River	49.0	675	674.1
	Nolin	49.0	515	515.2
	Barren River	53.0	552	547.9
	Rough River	2035.0	495	492.7

As of Sept. 13, 2007, reservoir levels are below the normal summer pool elevation at Taylorsville Lake in Spencer County, Green River in Taylor County, Barren River Lake

in Barren County, Rough River Lake in Breckinridge County, Grayson Lake in Carter County, Cave Run Lake in Rowan and Bath counties, Buckhorn Lake in Perry and Leslie counties, Yatesville Lake in Lawrence County and Fishtrap Lake in Pike County. It is noteworthy that both Barren River and Rough River lakes have been at or near the minimum release since mid-March, further evidence that the current drought conditions have been under development for some time.

Small Lakes and Water Supply Reservoirs

The Division of Water will monitor selected small water supply reservoirs when conditions indicate that water supplies may be threatened by persistent drought. Several small water-supply lakes are now approaching abnormally low levels and they will continue to decline with the precipitation deficit. Customer demand has forced a number of these water systems to call for conservation measures.